

CLAIMS

1. A method of cleaning a contaminated material which comprises a solid material which is contaminated with a hydrocarbon, the method comprising the steps of:

(A) contacting the contaminated material with a surface active agent thereby to form a first mixture including said contaminated material and said surface active agent;

(B) contacting said first mixture with a carrier formulation to prepare a second mixture wherein said carrier formulation is arranged to interact with said surface active agent and/or said hydrocarbon;

(C) separating said solid material in said second mixture from other components in the second mixture, wherein said solid material which is separated contains a lower level of said hydrocarbon compared to that in said contaminated material contacted in step (A).

2. A method according to claim 1, wherein said contaminated material contacted in the method comprises drill cuttings produced when drilling for oil or gas.

3. A method according to claim 1 or claim 2, wherein said contaminated material is contaminated with a drilling fluid and/or with petroleum.

4. A method according to any preceding claim, wherein said contaminated material comprises at least 5wt% of fluidic hydrocarbon(s).

5. A method according to any preceding claim, wherein said contaminated material comprises at least 5wt% of oil.

5 6. A method according to any preceding claim, wherein, in the method, a mass of said contaminated material is selected and contacted with said surfactant and the ratio of the wt% of said mass to the wt% of said surfactant is at least 10 and is less than 200.

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7. A method according to any preceding claim, wherein said surface active agent includes a hydrophobic moiety which has an aromatic ring system.

15 8. A method according to any preceding claim, wherein said surface active agent includes an hydrophilic moiety.

9. A method according to any preceding claim, wherein said surface active agent is an anionic surfactant.

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10. A method according to any preceding claim, wherein said surface active agent is wholly soluble in oil of the type contaminating the solid material at 25°C.

25 11. A method according to any preceding claim, wherein said contaminated material contacted in step (A) comprises 10 to 20wt% of hydrocarbon contaminant and 80 to 90wt% of drill cuttings.

30 12. A method according to any preceding claim, wherein said first mixture contacted in step (B) comprises 100 parts by weight (pbw) of solid material, 10 to 20pbw of

hydrocarbon(s); up to 5pbw of surface active agents; and up to 10pbw water.

13. A method according to any preceding claim, wherein
5 said carrier formulation contacted with said first mixture in step (B) includes a carrier which is arranged to interact with a hydrophilic moiety of said surface active material.

10 14. A method according to any preceding claim, wherein said carrier includes a polar moiety.

15 15. A method according to any preceding claim, wherein said carrier is a first polymeric material which includes a multiplicity of cationic moieties.

16. A method according to claim 15, wherein said first polymeric material includes hydroxyl groups pendent from a polymeric chain.

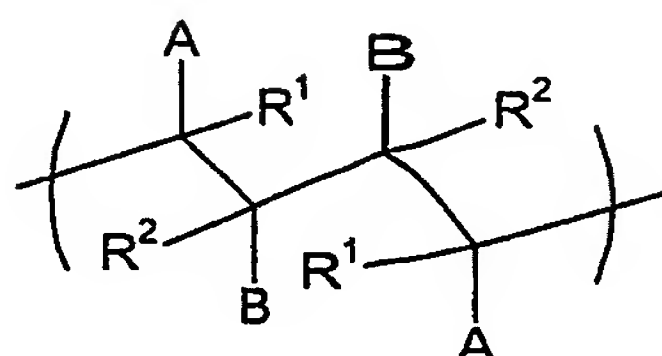
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17. A method according to claim 15 or claim 16, wherein said first polymeric material incorporates a polyvinyl alcohol moiety.

25 18. A method according to any preceding claim, wherein said carrier formulation is aqueous and includes at least 85wt% of water.

19. A method according to any preceding claim, wherein
30 said carrier formulation comprises a said first polymeric material which comprises a second polymeric material cross-linked by a third polymeric material, wherein said third polymeric material comprises:

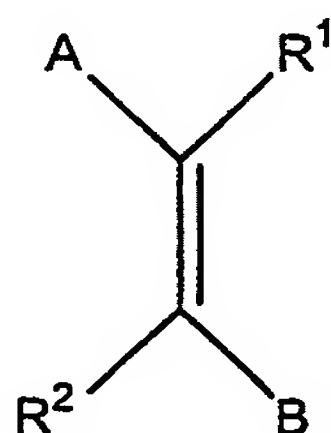
(i) a third polymeric material having a repeat unit of formula



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wherein A and B are the same or different, are selected from optionally-substituted aromatic and heteroaromatic groups and at least one comprises a relatively polar atom or group and R¹ and R² independently comprise relatively
10 non-polar atoms or groups; or

(ii) a third polymeric material prepared or preparable by providing a compound of general formula
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wherein A, B, R¹ and R² are as described above, in an aqueous solvent and causing the groups C=C in said
20 compound to react with one another to form said third polymeric material.

20. A method according to claim 19, wherein said third and second polymeric materials are reacted to form said
25 first polymeric material prior to contact with said contaminated material.

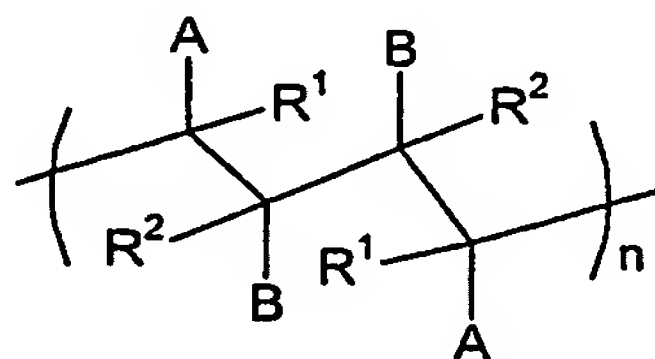
21. A method according to claim 19 or claim 20, wherein, prior to step (B), said method comprises selecting a said third polymer material; selecting a
5 second polymeric material which includes a functional group which is able to react in the presence of said third polymeric material to form said first polymeric material; and causing the formation of said first polymeric material by a reaction involving said third and second polymeric
10 materials.

22. A method according to claim 21, wherein the ratio of the wt% of said third polymeric material to the wt% of said second polymeric material selected for preparation of
15 said first polymeric material is less than 0.1 and is at least 0.01.

23. A method according to any of claims 19 to 22, wherein one of A or B represents an optionally-substituted
20 aromatic group and the other one represents an optionally-substituted heteroaromatic group.

24. A method according to any of claims 19 to 23, wherein R_1 and R_2 are independently selected from a
25 hydrogen atom or an optionally-substituted alkyl group.

25. A method according to any of claims 19 to 23, wherein said third polymeric material is of formula:



wherein n is an integer.

26. A method according to any of claims 19 to 25,
wherein said second polymeric compound is selected from
5 optionally-substituted polyvinyl alcohol, polyvinyl acetate
and polyalkylene glycols.

27. A method according to any of claims 19 to 26,
wherein said second polymeric material includes at least
10 one vinyl alcohol/vinyl acetate copolymer.

28. A method according to any preceding claim, wherein
in step (B) said second mixture is mixed to effect intimate
contact between the components therein.

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29. A method according to any preceding claim, wherein
step (C) includes allowing solid material to settle.

30. A method according to any preceding claim, wherein
20 after step (B) and before step (C), said second mixture is
contacted with further water.

31. A method according to any preceding claim, wherein
after step (C) the method comprises, in a step (D),
25 separating components which remain in said second mixture
from one another.

32. A method according to claim 31, wherein in step
(D), said carrier is caused to form a precipitate.

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33. A method of cleaning a contaminated material
comprising a solid material which is contaminated with a
hydrocarbon, the method including the steps of:

(A*) contacting the contaminated material with a first polymeric material and/or with second and third polymeric materials of the types described in any preceding claim to prepare a mixture; and

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(B*) separating solid material which is less contaminated than the contaminated material contacted in step (A) from other components in the mixture.

10 34. The use of a first polymeric material and/or second and third polymeric materials as described in any preceding claim, in the decontamination of drill cuttings.

35. Drill cuttings containing a trace of a first,
15 second or third polymeric material as described in any preceding claim.